Haskell Lake groundwater seepage investigation in support of lakebed porewater sampling

Sampling of porewater in the lakebed sediments has been proposed to assess impacts of the Haskell Lake Area Petroleum Contamination Plume to Haskell Lake. However, the locations and relative magnitudes of groundwater discharge to the lake down-gradient from the plume source are unknown. Fiber-optic distributed temperature sensing (FO-DTS) can be used to identify areas of groundwater discharge down-gradient of the plume source. FO-DTS uses backscattering of pulsed light in a fiber optic cable to measure temperature continuously along the length of the cable.

A FO-DTS instrument can be obtained from the USGS Office of Groundwater – Branch of Geophysics at no cost. In addition, Dr. Jean Bahr at the University of Wisconsin-Madison has agreed to lend us a 3,800 foot FO-DTS sensor cable at no cost. This reduces field equipment costs to shipping of the FO-DTS instrument and miscellaneous supplies needed to calibrate the instrument and install the sensor cable.

The cable will be deployed via wading with a real time kinematic (RTK) GPS unit (1 meter or less accuracy), and/or via a specialized boat with a similar GPS system that also records boat orientation. Both of these location systems will be critical in accurately locating the cable in space.

The FO-DTS investigation will be conducted in 2 trips. The first trip is anticipated to take 3 days, and will involve installing the cable and mapping its location. The length of Dr. Bahr's cable should allow for good coverage of the lakebed in the bay down-gradient of the plume (see attached figure, which shows a possible cable configuration). The FO-DTS instrument will then collect data over a period of several days. The FO-DTS instrument will likely have a weatherproof housing, but will need a secure location (protected from vandalism and theft, etc.). Ideally some preliminary data will be collected on the first trip to inform sampling. If a power supply and internet connection are available, it may be possible to obtain additional data via telemetry prior to the second trip.

The second trip will involve preliminary analysis of the DTS data, collection of porewater samples, and retrieval of the cable. Samples will be collected via temporary piezometers pounded into the lakebed by hand, using a peristaltic pump. Collected samples could be placed on hold at the lab pending more complete analysis of FO-DTS results. Alternatively, samples could be collected at a later date. However, this would require a high resolution GPS to ensure sample locations consistent with areas of groundwater discharge identified by FO-DTS.

The final product of the project would be a processed FO-DTS and a USGS Open-File report documenting the data collection, including maps of the results. A basic budget outline is included. The proposed budget assumes 2-3 USGS scientists in the field. Additional help may be available from graduate students at

the University of Wisconsin-Madison at little or no cost. The proposed budget does not include lab analytical costs.

Haskell Lake groundwater discharge study budget

Total project cost	\$19,098	
USGS cooperative water program matching funds	-\$6,366	
USGS overhead costs	\$8,441	
Total	\$17,023	
Equipment	\$1,000	Covers shipping for the FO-DTS instrument and additional expenses for setup, calibration and operation of the FO-DTS
Travel	\$1,500	Covers travel expenses for the proposed fieldwork
Labor	\$14,523	Salary and benefits to cover approximately 290 hours for 3 USGS scientists, including field investigation planning, the proposed fieldwork, data processing, and production of a report.